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ABSTRACT

A framework is offered for fostering systematic, creative synthesis across various case studies. The challenge for those seeking to synthesize from case studies is to develop respect for the individual case context while permitting some blurring of unique features to occur in the synthesis. Case studies are meant to render an account of specific events in the present or immediate past, whether from qualitative or quantitative data. They cannot be aggregated as statistical studies can. Generalizing entails applying conclusions from one set of circumstances to another set of circumstances. It differs from synthesis, which is the process of forming something complex from simpler elements. The process of synthesizing across case studies presented comprises a number of phases which are as follows: (1) beginning, (2) bounding the scope of the synthesis, (3) inventorying the cases, (4) reading the studies, (5) developing an interpretation of each case, (6) juxtaposing the cases, (7) synthesizing the cases, and (8) writing the synthesis. Technical, political, cultural, and moral dimensions must be regarded in the synthesis process. Two case studies of teachers illustrate the application of the process. (Contains 41 references.) (SLD)

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Building Explanations Across Case Studies: A Framework for Synthesis

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Developing general statements from disparate case studies has challenged researchers and practitioners from such diverse disciplines as clinical medicine, psychology, and the law as well as the social sciences generally. There is growing recognition in education, as well as other policy domains, of the value of single or multiple case studies to inform practice, increasing "the opportunities for and importance of synthesizing diverse studies" (Patton, 1990, p. 427). As yet, however, protocols or guidelines for synthesizing across specific cases are few and, as Miles and Huberman note (1984, p. 151), "developing a good cross-site synthesis is not a simple matter." The purpose of this paper is to provide such a framework. Offering more than a set of procedures, the paper develops ways of thinking (frames of mind, if you will) that foster systematic, creative syntheses across various case studies.

Because case studies by definition focus on specific instances of some phenomenon and are thus uniquely context-sensitive, they may well become context-bound. That is, the unique features of the case -- all of its wonderful, idiosyncratic messiness -- may hamper pulling out its more general messages, those it holds in common with other cases. The challenge for those seeking to synthesize, then, is to develop

protocols or frameworks that respect context while permitting some blurring of unique features to occur. Not unlike the photographer who focuses on certain elements of the scene and blurs others, the researcher seeking to draw inferences across specific cases must determine which elements to bring to the forefront in crisp outlines and which to place in the background. These elements are then abstracted to a higher level of generality, permitting some broad statements to be articulated about the cases.

The need for such synthesis may arise from a number of circumstances. A researcher may want to appreciate the state of scholarly inquiry in a particular domain; through a synthesis of case studies, new theory is created (Patton, 1990). An evaluator might want to extract "lessons learned" (Patton, 1990, p. 425) from case studies of particular programs or new practices through such a synthesis. In each instance, the researcher or evaluator builds new understandings in the area of interest through processes of induction and interpretation. Much more than the mere accumulation of knowledge (Eisner, 1991; Noblit & Hare, 1988), such syntheses offer new perspectives to frame the subject.

This paper first defines case studies, noting their essential features. It then moves to a discussion of the distinctions between generalization and synthesizing, and the various logic which guide them. Within the discussion of synthesizing, it describes a process -- a set of phases -- to

organize the activity. One framework for synthesizing across cases, found useful in other work, is proposed. Finally, this framework is applied to two case studies of mathematics curriculum reform.

Case Studies Defined

Case studies have a long and well-respected tradition in social science inquiry. Providing in-depth and detailed narratives about a specific case, such studies illuminate the complexities and relationships of one instance of a phenomenon. The case may be an individual, a group, a program, an organization, a set of organizations, a region, or a nation. Clearly, however, as we move to more complex instances, the capability of the case study to render a detailed account diminishes. Thus case studies typically focus on smaller levels of analysis and begin within a loosely demarcated context. The case is defined by the level of interest for concluding statements.

The salient elements of case studies have been defined as particularistic, descriptive, holistic, dynamic, and context-sensitive (see, especially, Merriam, 1988; and Yin, 1984). To these defining characteristics, we might also add that they are messy. Because boundaries are not clearly defined at the outset, labyrinthine pathways unfold as the inquiry proceeds; this makes bounding both the emerging analytic framework (the growing understanding of the phenomenon) and data collection messy.

Case studies are designed to render an account of specific

events occurring in the present or immediate past, and are complex and multi-layered. Merriam (1988, p. 11) notes that, because of this particularistic focus, case studies are "an especially good design for practical problems -- for questions, situations, or puzzling occurrences arising from everyday practice." Most case studies are descriptive or explanatory; that is, they depict events, processes, and perspectives as they unfold -- the "real-life context" (Yin, 1984, p. 25) -- and oftentimes build an explanation for those events or outcomes. Grounded in detailed description of the phenomenon, evaluation case studies are intended most often to provide logical, well-documented, and plausible explanations. To use Patton's (1990, p. 425, emphasis in original) term again, these case studies "identify and extrapolate *lessons learned*." Evaluation case studies may also be exploratory, seeking to describe a program or events with ambiguous or unclear outcomes, or be illustrative (Yin, 1984).

While case studies typically are constructed from qualitative research methods, this need not always be the case. Yin (1984) argues that case studies may rely exclusively on quantitative data, noting that they "need not always include direct, detailed observations as a source of evidence" (p. 25). While this may well be possible theoretically, in practice, few case studies are so designed. Most case studies rely on standard qualitative methods: participation, observation, indepth interviewing, and document analysis. These methods may be

supplemented by quantitative methods, most often tallies or frequencies of elements of the phenomenon. Certainly in analysis, the qualitative data typically lead the way, building a grounded, inductive description and/or explanation of events and perspectives. Fundamental to the choice of qualitative methods are the assumptions of cases studies which are far more interpretive than positivistic (see Burrell & Morgan, 1979, for a discussion of paradigms). These assumptions include (1) a valuing of the particular rather than the universal; (2) searching for and interpreting subjective, lived experience; (3) a stance of researcher humility faced with the daunting task of understanding that experience and rendering a just and ethical account; (4) valuing and validating multiple perspectives rather than law-like, predictive truth; (5) and a healthy respect for the power of context to shape and be shaped by actors in the setting.

These qualities of case studies make them, quite often, interesting reading and useful for illuminating important processes and relationships. These very qualities, however, demand a different logic than that of probabilities when we are interested in learning from several case studies of a particular phenomenon. Because of their inherent uniqueness, case studies cannot be aggregated as can statistical studies; they inform one another in totally different ways. The reasoning across cases becomes inductive, interpretive, and analogic, not unlike the logical processes that went into crafting the original case study

account. A subsequent section addresses this logic of synthesis; first, however, a discussion of generalizing is necessary to distinguish the two.

The Logic of Generalizing

Before focusing on synthesis as the process of interest, it is useful to distinguish synthesizing from generalizing because the processes are related. Generalizing entails applying conclusions (general statements or principles) drawn from one set of circumstances to another set of circumstances. There is a strong predictive element to it. That is, conclusions derived in one setting are argued to be predictive of outcomes in other circumstances. Eisner (1991, p. 205) notes that generalizing has a retrospective component as well, when general statements allow us to "see our past experiences in a new light".

The notion of generalization, however, has become impoverished in social science discourse, largely because of the hegemonic claims to its definition made by positivistic researchers. The concept has become restricted, "associated with notions of random selection and statistical significance" (Donmoyer, 1990, p. 176), thereby excluding its much more rich, evocative meanings. In its restricted sense, generalizing occurs within specified limits of confidence to the population from which a randomly-selected sample was drawn. That is, the results of the inquiry can be applied to the larger population, given the identified limits. Most often, however, consumers of the research report generalize the results far beyond the original

population, relying on a more full concept of generalization. An example I like to use in qualitative research classes follows.

Suppose we identify the population of women college presidents as the population from which we will randomly select a sample and then conduct some experiment (not a large enough population to begin with, my students always say, but bear with me). Because we do not have the resources to draw our sample from across the United States, we limit the population to New England women college presidents. We conduct the experiment impeccably, draw conclusions, and then want to generalize them. Ah, but we can only probabilistically generalize those findings to the population of women college presidents in New England. Someone in Arkansas is interested in learning from our research. Can our conclusions be of interest to them? Yes. Useful? Surely. Generalizable? Not according to the logic of statistical inference. But a logic of analogy, of comparison and contrast, allows the potential user (the person in Arkansas) to determine if the results of our study will be useful to his or her particular interests. And the writer of the experimental research report can identify those domains to which his or her findings can be fruitfully applied. Thinking about how research results illuminate other, similar circumstances is a softer, more humble and yet more rich concept of generalization than the restrictive notion. And, as Eisner (1991, p. 209) notes, "whether produced through statistical studies or through case studies, [generalizations in education] need to be treated as

tentative guides, as ideas to be considered, not as prescriptions to follow."

From the above, we can see that the notion of generalizing has at least two definitions of interest here; even in statistically-driven studies, it involves two decision spans (Cornfield & Tukey, 1956). One applies conclusions from the sample on which the study was conducted to the population from which that sample was drawn (assuming randomization and within specified confidence limits): the logic of probabilities. The other logic, that of analogy, applies those conclusions to another population or set of circumstances "believed or assumed to be sufficiently similar to the study sample that findings apply there as well" (Kennedy, 1979, p. 665). Also described as assertorial logic, this form of argumentation asserts or affirms that something is so, and draws on supportive evidence to convince the reader that conditions in the new circumstances are sufficiently similar to the original research conditions for generalization to be appropriate.

The Logic of Synthesizing

In contrast, synthesizing is a process of putting together parts into a whole, the formation of something complex from simpler elements. A synthesis is complete unto itself. The concept of synthesis suggests that the result of the synthesizing process is different from, more complex than, a mere aggregation of component parts. In chemistry, it means the creation of a complex compound by combining simpler elements. Thus the process

results in the creation of something new. As Strike and Posner (1983) describe it, synthesis "involves some degree of conceptual innovation, or employment of concepts not found in the characterization of the parts as means of creating the whole" (p. 346, quoted in Noblit & Hare, 1988, p. 16).

The logical processes that inform syntheses are inductive, interpretive, and analogic. Working from textual material, the writer integrates the disparate cases under consideration into a new understanding of the subject. Related to qualitative data analysis and literature reviews, syntheses identify general patterns, themes, metaphors, and images across the cases through the processes of comparison and contrast. Patton (1990) describes syntheses of disparate qualitative studies as "a form of cross-case analysis" but notes that these should be "much more than a literature review" (p. 425). Similarly, in one of the definitive works on synthesizing cases, Noblit and Hare (1988) note the link between syntheses and literature reviews but claim that the latter are all-too-often "the study-by-study presentation of questions, methods, limitations, findings, and conclusions [which] lack[s] some way to make sense of what the *collection* of studies is saying" (pp. 14-15, emphasis in original).

If we examine the literature on literature reviews, however, we find important parallels to syntheses across cases. Cooper (1988) provides a taxonomy of literature reviews, defining two goals of integrative reviews as (1) "synthesizing knowledge from

different lines of research" (p. 108, citing Jackson, 1980) and as (2) "inferring generalizations from a set of studies" (p. 108, again citing Jackson, 1980) or "formulating general statements from multiple specific instances" (p. 108, citing Strike & Posner, 1983). While distinctions are made between generalizing and synthesizing, they are clearly related processes which entail identifying general themes, patterns, metaphors, or "lessons learned" (Patton, 1990) from the disparate cases, and creating a new framework for understanding the subject.

More closely related to inferring and drawing conclusions than to generalizing, synthesis does not have the explicit predictive meaning that generalizing carries. Having said this, however, it is important to acknowledge that synthesizing also connotes the more full definition of generalizing outlined above. That is, having developed general statements that synthesize the salient elements, conditions, and "qualitative causal models" (explanations) of a set of cases, future application to other circumstances is often presumed and such applicability is a criterion of the value of the synthesis, especially in evaluation work (Guba & Lincoln, 1989; Patton, 1990). The logical processes of syntheses are inductive (inferring more general statements from disparate cases), analogic (distinguishing the cases through comparison and contrast), and interpretive (creating new meaning that integrates the cases into a new whole).

The Process of Synthesizing

Building on Turner's (1980) theory of social explanation,

Noblit and Hare (1988) propose a form of synthesis in which the central metaphors of cases are systematically compared with one another. We come to understand how social practices (cases) differ from one another by comparing them with each other and with our own experiences. The authors describe this as a process of **translation** which relies on interpretation and reasoning by analogy. Idiomatic translations, rather than literal ones, are compared. Thus rather than focusing on empirical observations of social practice (literal renditions), the synthesis "conveys the sense of things" (Noblit & Hare, 1988, p. 31). The synthesis is achieved when the central metaphors of various cases map fully onto one another.

Because the process is fundamentally interpretive, different researchers will focus on different aspects of the case, reflect on and integrate those accounts into their own differing experiences, and render different syntheses. This relativistic aspect of the synthesizing process is not unlike what we would expect from two different integrative literature reviews. Because researchers bring different experiences and conceptual lenses to the task, two reviews of the same literature would likely be organized differently, emphasize different elements of the texts, and draw different conclusions. In fact, this interpretation is what makes literature reviews (and syntheses of case studies) interesting. It validates and celebrates the authorship of the text and raises the resultant work above the mere recitation of previous studies so soundly critiqued by

Patton (1990) and Noblit and Hare (1988).

The following description of the process of synthesizing across cases is drawn largely from the work of Noblit and Hare (1988) with an important difference. Because the term translation (and their subsequent examples) are somewhat opaque, I have chosen not to use that term. Eight phases are presented, although the reader should be clear that these phases are not necessarily sequential. The processes of induction, interpretation, and analogic reasoning are messy and iterative and should not be viewed as a lock-step series to be slavishly followed. Rather, I identify phases to sensitize the reader to the complexity of the task and to provide some guidelines. I have merged some aspects of Noblit and Hare's (1988) phases, resulting in somewhat different labels for phases 5, 6, and 7, and I have introduced a new one, phase 3. The discussion of each phase is my own interpretation and draws in part from previous work on designing qualitative studies (Marshall & Rossman, 1989; Rossman & Marshall, 1992).

Phase 1: Beginning

This phase entails locating an area of interest that will sustain the researcher through the process. Because the synthesis process can become tedious, it is crucial that the subject hold sustaining interest. Elsewhere we (Rossman & Marshall, 1992) refer to this as the "want-to-do-ability" of the work -- that compelling-ness that moves us forward when the drudgery of the task becomes nearly overwhelming.

Phase 2: Bounding the Scope

This phase places initial boundaries the scope of the synthesis. Will it embrace **all** case studies on the subject? those that are representative in some way? exemplary? critical? Essentially a process of selecting the cases to be included in the synthesis, this phase is hampered by the historic demand that literature reviews (and, by association, syntheses) be exhaustive. In his taxonomy of literature reviews, Cooper (1988) provides some alternatives. While reviews may well be exhaustive (although in today's world of knowledge explosion that seems a daunting task), considerable value lies in those that are representative, central, or pivotal (Cooper, 1988, p. 109). Noblit and Hare (1988, p. 27) note that judging which cases to include depends on the audience for the syntheses, their particular interests and concerns, as well as the researcher's own interests in the subject. They go on to state that there is no particular value in being exhaustive, and that the substantive interest driving the synthesis should determine those cases selected.

Phase 3: Inventorying the Cases

Several elements of the cases should be described initially: focus, goals, scope, complexity, organization, and audience. Using these categories at the outset of the process sensitizes the researcher to more formal points of comparison and contrast among the cases. And while the cases may be quite different in, for example, organization or focus, this does not preclude

synthesis. In fact, Patton (1990) provides an example of a synthesis conducted on different subjects, noting that such syntheses can help us "learn lessons about effective human intervention processes more generically" (p. 426). Each element is briefly discussed in turn. The examples provided are particularly relevant for case studies of curriculum reform.

Focus. Alternative focuses for case studies of curriculum reform could include the curriculum itself, implementation strategies, instructional practices, student outcomes, professional development, the culture of the classroom, professional associations or state agencies. The researcher should identify the primary focus of each case study and list it, perhaps in a matrix to facilitate comparison among the cases.

Goals. Goals of the case studies might be to inform policy at the national, state, or local levels; to change practice at the classroom level; to contribute to knowledge; to radically alter professional associations; or some combination. Identifying and listing each study's goals helps the researcher understand the study's implications and potential parallels with others. Some form of matrix display such as those described so fully by Miles and Huberman (1984) could enrich this phase of the process.

Scope. This element embraces the level of analytic interest of the study as well as its depth and duration. Analytic level ranges along a continuum from the individual to the nation. A study of a higher-order thinking skills curriculum, for example,

could be of the changes in cognitive skills of one child. Another study with the same focus might be of a classroom and all the children within it. Given current interest in the new NCTM standards, one might locate case studies of the adoption of those standards by state departments of education or of changes in the professional association itself. Each study has a successively broader scope and therefore greater complexity. Scope is further determined by the intensity of data collection and its duration. Thus the study of one child might be for one day (short duration) but quite detailed (indepth). The classroom study could be for an entire cycle (the school year) but rely on data gathered at three one-day site visits. Identifying and listing these aspects of the scope of the study fosters comparison among the cases.

Complexity. Case studies can also vary in terms of variety of methods. One might focus indepth on children in a single classroom where new mathematics instructional strategies are being implemented and rely exclusively on qualitative research methods. Another might aim more broadly at several classrooms within a school and use a mix of interviewing, holistic observation, quantitative observation protocols, and standardized test scores. Again, determining the complexity of the research methods facilitates comparisons among the cases.

Organization. Case study reports may be organized temporally, thematically, by individuals (students, teachers), by groups (naturally-occurring or organizationally imposed), or by some other means. These structures are part of the conceptual

framework of the study and shape the conclusions presented.

Audience. Like all research reports, case studies are written with an audience in mind (or at least they should be). These audiences might include specialized scholars, general scholars, teachers, administrators at various levels, funding agents, policy makers, or the general public. The identification of audience shapes the narrative and in part determines which elements of the case are brought to the fore. In evaluation work, moreover, critical tests of the study's value are "its meaningfulness and utility to evaluation users" (Patton, 1990, p. 428). This is certainly the group that commissioned the work as well as other potential users of the study.

Phase 4: Reading the Studies

This phase entails immersion in the cases -- repeated reading and reflecting on the texts. From the literature on the creative process (see, for example, Bargar & Duncan, 1982), we learn that this phase is essential for novel, insightful syntheses. The researcher must live and breathe the texts, coming to know them intimately. This process can be tedious and confusing, as the researcher struggles with the ambiguity and complexity of the details of the cases. The challenge here is avoid premature interpretation, to "liv[e] for as long as possible with that complexity and ambiguity, coming to terms with it, and ultimately passing it on to the reader in a form that clarifies and deepens" (Miles & Huberman, 1984, p. 251). The cases need to incubate -- to stew, if you will -- in the

researcher's mind.

Phase 5: Developing an Interpretation of Each Case

After immersion in the set of cases under consideration, the researcher focuses on each case in turn to identify the key metaphors that illustrate the central meaning(s) of the case. This may be driven by a conceptual framework constructed prior to beginning the syntheses (always held tentatively, however), or may be more purely inductive. Although knowledge of the other cases shapes this process, the researcher tries to focus on one case and develop a grounded interpretation of that case. This interpretation is intimately linked to the researcher's own experience of the subject. As Noblit and Hare (1988, p. 28) suggest, lists of metaphors, concepts, and themes as expressed in phrases or vignettes are useful to construct. These represent the interpretations of the cases. The challenge here is to develop interpretations sufficiently general to be comparable to the other cases yet grounded in the details of the specific case.

Phase 6: Juxtaposing the Cases

Here analogic reasoning comes to the forefront as the researcher compares and contrasts the various interpretations. One case is like another in what ways? different? extends and elaborates? How do the central metaphors relate to one another both within the cases and across cases? Which metaphors provide the most explanatory power to capture the essences of the cases? Which metaphors most cogently, elegantly, and economically describe the set of cases? This process entails comparing

themes, metaphors, and explanatory stories across cases. During this phase, it is likely that comparing the interpretations will lead to new insights into the cases -- a reconceptualization of the entire work. Here, as in Phase 2, the use of matrices can enliven the process.

Phase 7: Synthesizing the Cases

Phase 6 flows from the previous phase as the common patterns across cases coalesce into a grounded theory of the subject. Miles and Huberman (1984, p. 228, brackets added) describe this phase of the process as "moving progressively up from the empirical trenches to a more conceptual overview of the landscape. We are no longer dealing just with observables [cases] but also with unobservables [interpretations], and are connecting the two with successive layers of inferential glue." This "inferential glue" is the stuff of synthesis, a grounded theory of the subject that tells us something new while preserving the sometimes contradictory specifics of the cases.

Phase 8: Writing the Synthesis

This final phase entails writing the synthesis which should be true to the original purpose of the work, crisp in style, loyal to the details of the cases, but provide a more complex understanding of the subject than does any single case. The style of the narrative should respect the intended audience, as discussed above. As Noblit and Hare note (1988, p. 29), "often, audience needs drive the form and substance of the synthesis." The synthesis is greater than the sum of its parts: because of

its interpretive and heuristic nature, the synthesis develops new insights into the subject, offering the reader an opportunity to reflect on his or her own experience in light of that synthesis and to engage in a fresh conversation about the subject.

Again, a caution or two. These phases, derived in large part from Noblit and Hare (1988), are not prescriptions but rather guidelines for working through the messy, sometimes tedious, often exciting process of synthesizing a set of case studies. And as yet they remain rather abstract. An example of the process at work is provided after discussion of one possible framework that could guide synthesis. This framework is offered as an alternative to a more purely inductive approach, one in which the categories of metaphors are derived exclusively from the cases. I have chosen this strategy because I believe that it facilitates the process -- keeps it focused -- without unduly constraining creativity. That framework is presented next.

A Framework for Synthesis

Alternative conceptual frameworks will shape the synthesis across cases, each in its own unique way. One could argue for a framework that focuses on the intra-individual change (student or teacher) that occurs when constructivist approaches to mathematics and science are introduced. Similarly, one could argue for a framework that captures the interpersonal changes occurring as individuals negotiate and re-negotiate classroom and school-level regularities of behavior. Issues of power would be touched from this framework as definitions of authority for

knowledge claims are challenged and redefined. Group or organizational frameworks draw attention to other, equally salient elements of the cases. Finally, each case is embedded in larger socio-political and temporal contexts that both shape and are shaped by classroom events. A lens that focuses from the larger social context will naturally sharpen some elements and blur others. Each framework can legitimately be defended as fruitfully contributing to synthesizing across case studies.

In two recent policy studies (Anthony & Rossman, 1992; Wilson & Rossman, forthcoming), we have relied on a framework that is not new but that has proven useful in illuminating the complexities of systemic change in educational settings. Both endeavors are multi-site case studies; both have individual cases embedded in the larger work and necessitate cross-case syntheses. Although used for cross-case synthesis in both instances, the framework is also useful for synthesizing across disparate case studies. I first explicate the framework, then apply it to two case studies of curriculum reform.

The Framework: Political, Technical, Cultural, and Moral Dimensions

Derived from studies of educational change, this framework looks at the political, technical, cultural, and moral dimensions of systemic change. The first three constructs have been developed by others to interpret organizational change (Tichy, 1983), innovation in schools (House, 1981), and most recently

tracking in schools (Oakes, 1992)[1]. What has not been incorporated is the moral dimension[2].

The moral elements of education have long been acknowledged by philosophers of education. Dewey (1916), for example, argued that educational discourse should be grounded in moral principles. More recently, that view has been espoused in critiques of the disciplinary structure of high schools (Noddings, 1992), calls for caring in the teaching profession (Noblit & Rogers, 1992; Goodlad, Soder, & Sirotnik, 1990), the moral dimensions of leadership (Sergiovanni, 1992), and analyses of the transmission of ethical principles (Sichel, 1988).

A conceptual framework guiding the synthesis of case studies of curriculum reform could fruitfully incorporate all four dimensions. These provide initial frames to organize the interpretation and juxtaposition of cases, as well as a structure for crafting the final narrative. While the dimensions sensitize the researcher to themes and metaphors within and across the cases, they should not be slavishly applied. Yet we have found them useful in organizing our thinking about systemic change. Each dimension is briefly discussed; the final section of the paper applies the full framework and the process of synthesizing to two case studies of curriculum reform.

The technical dimension. The technical dimension of change

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[1] Oakes uses the term **normative** to refer to the cultural dimension.

[2] This discussion draws largely from Anthony and Rossman (1992) and Wilson and Rossman (forthcoming), with the authors' permission.

draws our attention to the knowledge and skills required to transform resources into some process or outcome. This alerts us to look for ways a curriculum reform initiative has paid attention to building knowledge and skills in those affected: children in classrooms; teachers who need risk-free opportunities to learn and practice new skills (Little, 1982); superintendents and school board members who need knowledge and skills to share power and authority, and to shape a vision of reformed classrooms and schools.

The political dimension. This dimension focuses on power, authority, and influence as well as conflict and negotiation. It highlights how conflict is managed and compromise or integrative solutions reached. This calls our attention to how multiple perspectives -- and demands -- are respected within a reform initiative, and whether resources are allocated according to principles of fairness and justice.

The cultural dimension. The deeply-held and widely-shared values, beliefs, and norms of the school -- its definitions of what is and ought to be -- both shape and reflect a group's sense of itself. While a general ethos may be apparent, competing definitions at times war with one another. Current curriculum reform in mathematics and science, grounded in constructivist assumptions, represents nothing short of a rethinking of education. It demands a move from individualistic, competitive, teacher-centered models to group-oriented, cooperative definitions of education where children create knowledge and the

teacher is a facilitator, an architect of the environment, and a resource. Teachers and children become co-learners. The cultural dimension draws our attention to these belief systems and underscores the compelling ways they shape everyday life in schools.

The moral dimension. Principles of justice and fairness are the focus of this dimension. Arguing that we make moral choices when we make decisions that affect other people's (children's) lives, this perspective gently reminds us to pay attention to the heart and spirit as well as the head in education (Noddings, 1992). It calls on us to consider the rightness of our decisions.

This framework can be useful in guiding interpretations of cases, juxtaposing them, and crafting the synthesis. It is next applied to two case studies of mathematics curriculum reform.

The Framework at Work

The cases selected for this example of synthesis are both classroom-level studies of mathematics curriculum reform resulting from, and linked to, the new NCTM standards. The first, by Bruckerhoff (1991), is a study of the Cleveland Collaborative for Mathematics Education (CCME) in which he portrays the effects of participation in the collaborative through an indepth portrait and analysis of the experiences of one junior high school mathematics teacher. The second (Weimers, 1990) is also of one teacher's experiences with mathematics curriculum reform, although this teacher teaches fifth grade and

the case study is part of a set of articles published in the fall, 1990, edition of Educational Evaluation and Policy Analysis. Thus although this second case was not strictly intended to stand on its own, I have selected it because it facilitates the synthesis process. First, the cases are described (we have already waltzed through phases 1 and 2) through an abbreviated inventory (phase 3). Next an interpretation of each case is presented (phase 5, which assumes that I read and reflected on the cases [phase 4]), drawing out the central themes and metaphors of each. This interpretation is organized around the four dimensions of systemic change of the framework described above. Next the cases are juxtaposed (phase 6) and a synthesis developed (phase 7). And, of course, this text represents the final phase of the process.

The Cases

James Engle. The centerpiece of this case is a rich, detailed description of the everyday life of James Engle, a 45-year-old junior high school mathematics teacher. Although we learn only generally how the author gathered the data on which the case is constructed, the portrait elegantly interweaves observations of Mr. Engle's classroom with long quotations from interviews with him, all framed by the author's interpretation.

CCME is a city-wide collaborative for mathematics teachers, designed to provide professional growth and development for participants and to infuse the NCTM standards into everyday practice. Mr. Engle participates in the collaborative, serving

as a representative to its council. The purpose of the case study is to depict the ways in which CCME has shaped teachers' thinking about mathematics and mathematics instruction through Mr. Engle's experiences and perspectives. Its central focus is on the professional validation Mr. Engle receives through participation in the collaborative contrasted with the stark everyday struggles he encounters teaching in an inner-city school.

Joe Scott. Joe Scott is a fifth grade teacher in a "traditional" elementary school in California. Math is his favorite subject and he is well known throughout the district for his excellence in mathematics instruction. Joe's experiences in the classroom and his thinking are vividly presented in the case, drawn from data gathered in two week-long site visits over the course of a school year. As in the first case, the portrait of Joe's everyday life in the classroom is evocative and concrete, as observations, interviews, and the author's interpretations are blended in an engaging narrative. The purpose of this case is to depict the implementation of California's *Framework* for mathematics education, a framework derived largely from the NCTM standards. The focus here is on the conflict between Joe's perspective on the goals of mathematics instruction and the demands for change embedded in the California *Framework*.

The cases, then, are similar in focus, organization, goals, scope, and audience, and seem similar in complexity. Both end with interpretations aimed at policymakers and policy

implementers, raising important questions for the reform of mathematics thinking and instruction. And, as this paragraph demonstrates, the process of comparing and contrasting the cases has already begun.

The reader can also see how the framework might be useful as we begin thinking about the cases. Each must have technical dimensions as the teachers negotiate demands to alter their practice; each is embedded in a larger political context, either district or state; cultural issues arise when we think about the beliefs and values of each teacher and the values espoused in the new standards; and the moral dimension becomes clear as we surmise that the teachers must struggle with issues of what is right for their students in this process of change.

Themes and Metaphors

James Engle. Mr. Engle constructs daily life in his classroom around **the homework curriculum**. Adopted by CCME in response to the enormous demands of teaching children of poverty and dysfunctional families, this curriculum is textbook centered and instruction follows a pre-determined order: "bellwork assignment, bellwork check, homework check, homework lesson, and homework assignment" (p. 166). Although warm and caring towards his students, Mr. Engle tightly directs instruction in this noisy school with no soft surfaces (Eisner, 1991), where absenteeism is extraordinarily high, and where students are disengaged from this model of learning.

CCME provides Mr. Engle with a **lifeline** of professional

validation: teachers matter in this consortium and he derives great satisfaction from participation. CCME has come to be like a **department chair**, providing resources and collegiality that should be available to every teacher in every school but, unfortunately, are not. In this impoverished setting, CCME has fostered rededication of commitment and cautious rethinking of mathematics instruction but little change in daily practice.

The principles espoused by NCTM stand in stark contrast to the realities of Mr. Engle's daily classroom life, and he has become increasingly aware of this **schism**. He thinks differently about mathematics now, more globally, and feels more committed to teaching in new ways although little has changed in his instructional practice. District demands for a direct instruction model, one that standardizes teaching, make change difficult. Mr. Engle feels safest with the homework curriculum, a tightly ordered sequence of classroom events that will, in his belief, best help Cleveland students learn mathematics.

Joe Scott. Dynamic, exciting, intensely competitive, and highly engaged as a teacher, Joe describes himself as **the captain of his ship**. Fiercely competitive and teacher-centered, his classroom pops with rapid-fire direct instruction that is textbook driven. Joe makes a bargain with his students: good grades mean less homework. Posters around the room celebrate the students with excellent scores on tests; timed quizzes are given often; and mathematics is describes as a **tool**. Joe wants his students to memorize procedures and be able to apply them

rapidly. Reflection, exploring alternatives routes, and divergent thinking aren't present in this classroom.

Joe quite explicitly confronts the principles of NCTM as expressed in the California *Framework*. Although he agrees with the goal that all students should be successful, he defines this quite differently from the standards and dickers with the means to achieve that end. Prodded into more problem solving and use of pictorial representations by a new textbook, Joe turns the former into another "discrete skill" (p. 306) to be mastered by students. They respond to problem-solving questions in "**boot camp** fashion, neither explaining their strategies nor validating divergent ideas" (p. 307, emphasis added).

Joe has few reasons to change. He is hugely successful, as measured by standardized test scores and the performance of his students in sixth grade. The only prod to change comes from the larger state context, as expressed in the textbook. No interpretation of the *Framework* has been given to Joe, nor has he received support in learning about constructivist philosophy. And Joe believes that he is right, that he is serving his students as best he can and as they should be served.

Juxtaposing the Cases

There are several points of similarity and contrast between the two cases. In terms of the technical considerations, both teachers run a kind of **boot camp**. Classroom organization and flow are tightly directed, students have no voice in either those structures or the content of learning, and the teacher is **the**

captain of the ship. The reasons for these technical decisions vary, of course. Mr. Engle's seems to be in response to a changed student population who, in general, see little value in formal schooling. School, for some, is the only safe place they know -- a haven of sorts from violence and poverty. Joe's enormous historic success with high-energy direct instruction gives him little reason to change.

Both teachers are prodded -- but only gently -- by a larger political context to think in new ways about mathematics instruction. The California context, with its historic reliance on incentives for local reform (Timar & Kirp, 1988), challenges Joe indirectly through its **textbook-as-change-agent** strategy. Mr. Engle has undergone a kind of professional revitalization through CCME, but **swims upstream** against the tides of district policy, traditional textbooks, and the struggles for order and engagement in a classroom where on any given day more than half the students are absent.

The clashes of cultural values are seen in the philosophy of mathematics curriculum reform and the teachers' personal philosophies of teaching. Joe sees great potential in constructivist approaches but cannot implement them in his classroom; thus his espoused theory increasingly grates against his theory-in-use. Perhaps his thinking in new ways will slowly wend its way into his practice. Mr. Engle likely will transform new initiatives into new **tools**, thereby observing some form with little change in his philosophy.

The moral themes in the cases are less clear, although both teachers seems to believe they are doing right by their students. Joe's success (measured by test scores) reinforces his current thinking and practice; Mr. Engle's success (measured by accomplishing the homework curriculum) admits of no real alternatives although he expresses doubts that teachers are achieving their professional potential.

Synthesizing the Cases: Building a Grounded Explanation

Synthesizing the cases allows us to see larger patterns than does either case examined alone. The challenge here is to build an explanation for the lessons learned (Patton, 1990). What have we learned from these two cases? From one vantage point, a **textbook strategy** of mathematics curriculum reform has mixed results. In the CCME case, strict reliance on the textbook, as seen in the homework curriculum, is one component of a **tangled web** of district policy and does little to foster curriculum reform. The press for reform comes from other policy arenas: the national discourse (NCTM) and the collaborative. In the California example, the textbook has seduced the teacher into considering alternative instructional practices but these are redefined to suit the teacher's definition of mathematics. This strategy is the result of historic relations between the state and locals and a function of limited state resources to provide professional growth opportunities.

In both cases we see the potent influence of local context to shape teachers' thinking about teaching in general and

mathematics specifically. The technical decisions the teachers have made about what constitutes mathematics knowledge and how to enact that curriculum within their classrooms depend, at least in part, on their interpretations of what their students need. Their solutions to the technical problems of teaching mathematics rely on past practice rather than inventing new solutions or turning to the ideas embedded in the NCTM standards. And while the teachers reflect on specific lessons, or parts of lessons, and critique them ("that part didn't go as well as I would like"), their solutions are to do what they have been doing, only better or more.

The political dimensions of the cases differ. In the immediate political realm, one teacher struggles upstream against a large bureaucracy where, at times, administrators are incompetent, punitive, or even bizarre. The lack of support some teachers experience dampens spirits in an already challenging educational setting. And the district press for a competency-based, direct instruction mathematics curriculum places teachers under conflicting demands. CCME is a lifeline of professional support and validation but confuses the technical realm by calling for substantially altered practice. These layers of policy imperatives and suggestions further confuse the web of conflicting messages. In the other case, the immediate political arena supports and rewards the teacher's current practice, providing little incentive to change. Gentle press for change comes from the state.

And, finally, the cultural and moral dimensions of the cases highlight the potential for curriculum reform to challenge "sacred" (Rossman, Corbett, & Firestone, 1988) values of teachers. Both teachers hold deep convictions about what constitutes mathematics knowledge, what its purposes are, and how best to help students learn mathematics. In the California case, reform directly challenged those sacred beliefs, creating intolerable dissonance. The teacher reconceptualized the *Framework* to better suit his definitions of mathematics knowledge thus subverting the goals of reform. In the Cleveland example, CCME provided an environment to learn about mathematics reform, challenging the teacher to implement those ideas in his classroom. Faced with daunting conditions, however, he is as yet unable to alter daily practice. In both cases, mathematics reform has challenged deeply-held beliefs about knowledge and instruction.

A Summation and Comment on Reform

A synthesis of these cases reveals larger patterns instructive for policymakers and those implementing policy. While none of the lessons learned is particularly new, the synthesis provides more evidence for reasoned thought in the policy process. If the goals of mathematics curriculum reform, whether emanating from professional associations or state departments of education, are reconceptualized knowledge and practice in classrooms, attention must be given to the multi-faceted dimensions of systemic change. The framework fosters

such thinking. The synthesis across cases allows us to picture daily life in schools while sensitizing us to larger patterns in the policy reform process.

Current reform efforts, those that stand in stark contrast to the standards-raising efforts of a decade ago, seem to demand a consideration of the unique that such syntheses foster.[3] The current emphasis on systemic change (Elmore, 1990; Schlechty, 1990; Barth, 1990; Jacobson & Conway, 1990), in our opinion, represents nothing less that a "new" philosophy of education. We place new in quotation marks because its fundamental assumptions are not new -- they have been with us for a long time. It seems that, at least in part, their time has come.

Five assumptions underlie this evolution of the reform movement. First are the changing conceptions of change. Historically, educational researchers and reformers thought of change as innovation -- something discrete, definable, and relatively-easily installed in schools. This technical, or "engineering" model of planned change was built on the assumption that experts could best understand the needs of those in the targeted system, and that implementation depended on persuasion (Benne, Bennis, & Chin, 1976, p. 17). Innovations were elements of education, most often new curricula, developed with the help of experts in colleges and universities and intended to be implemented as designed in classrooms. Designers sought to

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[3] The following discussion is taken from Wilson and Rossman (forthcoming) with the authors' permission.

"teacher-proof" the curricula, thereby avoiding the nasty problems of context. In fact, the power of context to shape the installation of such innovations remained obscure.

Today, however, conceptions of change are neither linear nor context-free. Instead they focus on the centrality of local context and value the talents of the individual teacher to modify, adapt, and individualize new ideas to better suit the diversity of the students present in the classroom, as well as his or her own predilections and professional skills. Change is viewed as complex, multi-faceted, messy, and systemic: altering the curriculum, from today's view, has profound implications for teaching strategies, organizational structures and supports, professional relations, as well as a host of other elements of schools (Cohen, 1983).

Second, today's calls for systemic change are grounded in a different view of the learner than those of a decade ago. Constructivist assumptions, ones that view the learner as a creator of knowledge, are embedded in the NCTM reforms, as well as in whole language approaches to reading, process writing models, and experiential approaches to science, to mention a few. These ideas challenge the assumptions of the first wave of reform in which, it can be argued, the learner was still viewed as a receiver of knowledge. This assumption focuses on the creation of knowledge and the role of direct, hands-on experience in the construction of that knowledge.

Third, these conceptions of the learner have direct and

immediate implications for instructional practice. Rather than a giver of information, the teacher becomes the architect of an environment in which students can engage in meaningful learning experiences, carefully monitored and guided by the teacher. The teacher becomes a resource, a co-learner along with the students, and an active participant in the construction of knowledge. These views are radically different than those embedded in reforms that focused on standards and outcomes, ones that at times called for the assessment of teachers by student achievement.

Fourth, the notion of outcomes is changing. At least one camp calling for systemic change places on center stage a more holistic view of the "product" of our schools. This position assumes that students should be independent, complex thinkers who can also work effectively in groups of their peers. Rather than having mastered an identifiable, discrete "body of knowledge" (one determined by the teacher and/or the curriculum), students display complex knowledge and skills in areas, in large part, of their own choosing (ones that best suit their own particular talents and challenges). This notion of the "what" of education demands more supple and complex means of assessment. Authentic assessment is a more variegated, complex, and multi-faceted form of evaluating student performance than simple reliance on standardized testing. Portfolios and exhibitions, such as those developing at the Central Park East School, are seen as more natural and respectful of the whole individual than narrower

forms of testing. This position represents an entirely different set of assumptions about evaluation and performance than previous ones.

Finally, today's calls for systemic change are inclusive and caring rather than exclusionary and tracked. Driven by concerns about distributive justice and equality of access to educational resources, this perspective argues that our educational system has become more separatist than egalitarian and that, over the past two decades, we have responded to differences in students by "creating new and separate" programs for the gifted, the disadvantaged, and the at-risk, as well as for students with disabilities (Kane, 1991, p. 2). These programs create segregated systems where both students and teachers have become increasingly specialized. Arguing that this is inherently undemocratic, this final assumption calls for schools and classrooms where empowered and caring people work through flexible and democratic structures that are responsive to the diversity of the students they serve.

Syntheses of case studies trying to describe and explain the challenges of bringing about such far-reaching change in schools will provide us with wonderful, evocative descriptions as well as general patterns. These, in turn will shape our expectations and sensitize us to the complexities of systemic change.

A Framework for Synthesizing Case Studies

	nested contexts					
	individual	classroom/ group	school	district/ region	state/ region	national
dimension of systemic change						
technical						
political						
cultural						
moral						

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